

# Signal or noise, a statistical perspective

Best practices about the appropriate use of statistical tools in sport and clinical sciences are increasingly being fostered. For the sake of science, the interpretation of the result of an experiment is the central key, which features the interpretation of the phenomenon. Recently, an interesting article in PNAS (1) shows that musical agency reduces perceived exertion during strenuous physical performance. Considering the experimental approach and data analysis, we also perceived this phenomenon as intriguing. However, the methodology approach requires stronger certainty because science must first reduce uncertainties to interpret effectively the collected results. We will discuss some points in this letter to clarify the question of “signal” and “noise.” In the study in question, the age range was wide (18–59 y): a different maturation level significantly affects the perceived exertion (2). The two to three different conditions were counterbalanced, but administering all of them during the same day, albeit at different times (3), could have caused an uncontrolled fatigue effect. Not all measures (1) have been verified in terms

of measurement reliability (4). This point is crucial, because the authors only report laboratory spirometer  $\text{VO}_2$  accuracy. Given the physiological–psychological translational nature of this study, the experimental design is rather complex, making replication difficult. We agree that the “ratio” approach is fascinating, but, because the original results are not provided, the study repeatability is impaired. Considering the psycho-physical nature of the Borg scale, its poor accuracy (5), and the related documented relationship with age (2), the high variability featured in the study results of Fritz et al. seems to reflect more interindividual variability (noise) than the effect of a potential neuro-physiological phenomenon (signal).

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